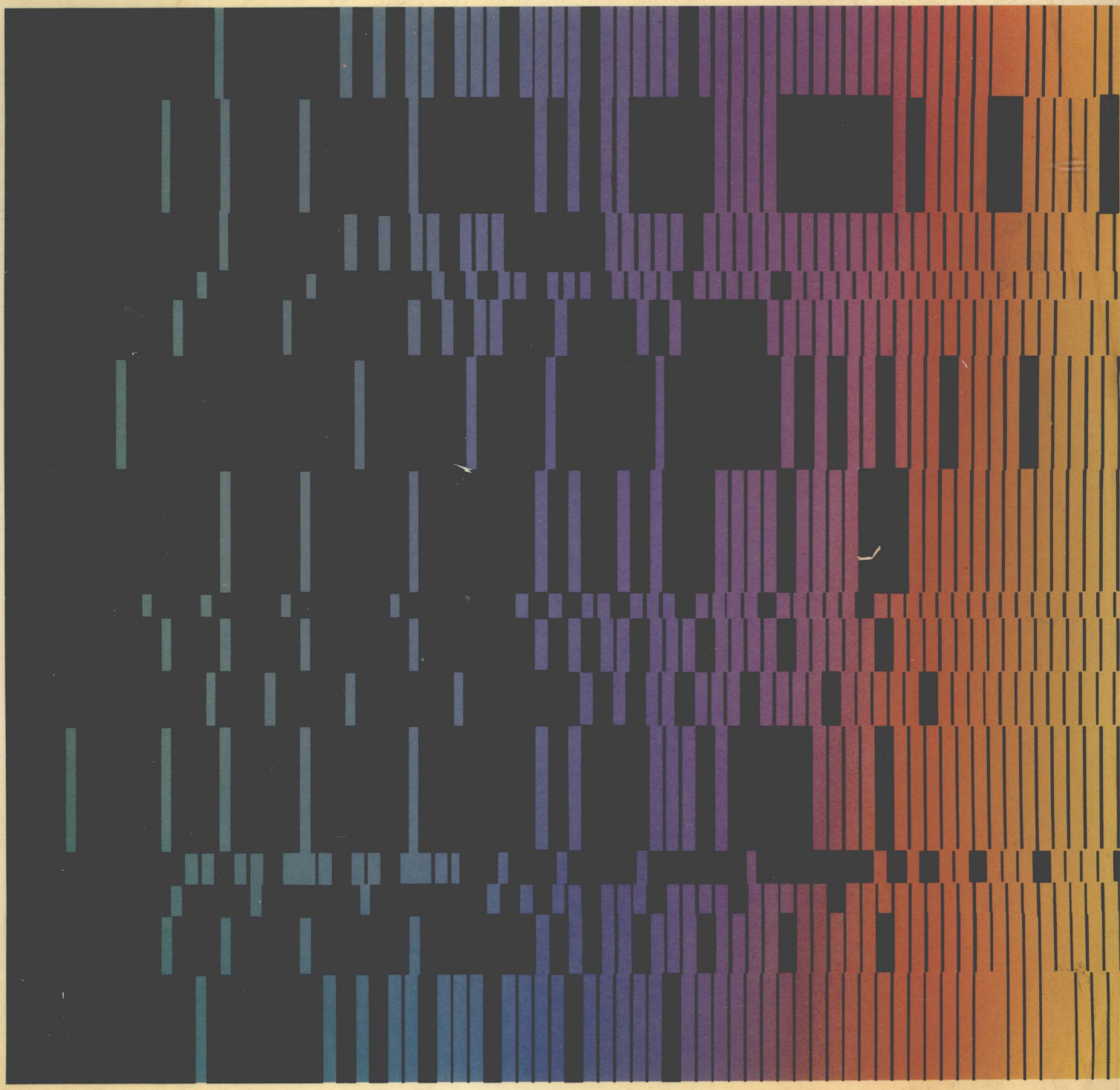
DATABASE PROCESSING
FOR MICROCOMPUTERS



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Preface

At this moment there are hundreds of thousands of microcomputer users making needless mistakes. These people, who are users of microcomputer databases, are falling into pitfalls that were discovered by information systems professionals ten to fifteen years ago. The goal of this book is to make the knowledge gained by these battle-scarred database experts available to users of microcomputers.

Background

Although the information systems industry has been fast-paced and continuously changing since its inception in the mid 1950s, nothing prepared the industry for the tornado-like impact of the microcomputer. Micros have changed people's orientation to information systems in ways that will not be fully comprehended for another twenty years.

Among its many effects, the microcomputer threw database technology into a morass of confusion. For example, no knowledgeable database specialist would say that Lotus 1–2–3 is a database management system. Yet, when surveyed, users consistently report Lotus 1–2–3 as their primary database manager. Furthermore, there are today perhaps 10,000 knowledgeable experts in database technology who would say that two million or so users of Lotus 1–2–3 and Pfs:file are misusing the term *database management*. Even more confusing, the most popular micro database management system (in terms of numbers sold) is dBASE II, yet this system falls far short of meeting the definition of a database management system as set out by E. F. Codd (see the bibliography), who is generally recognized as the world's leading database expert.

Meanwhile, oblivious to the experts, millions of people have installed database managers (of some ilk) on their micros and are accomplishing useful and productive work. Unfortunately, since these users are not aware of the technology developed by database specialists, they are needlessly making many of the mistakes that information systems professionals have learned not to make. In writing this book, we have endeavored to bring relevant learnings from mainframe computer databases down to the level of the micro. Our hope is that you will be able to avoid the mistakes that we and others have already made.

Mainframe vs. Microcomputer Databases

There are many differences between a database on a mainframe computer and one on a microcomputer.

Mainframe databases are generally far more complicated in structure and contain considerably more data. A large mainframe database has several billion characters, whereas a large micro database has several million.

Even more important, mainframe databases are shared. They serve a community of users, and consequently, their processing must be standardized and controlled. With the exception of local area network applications (see Chapter 15), micro databases exist on a single computer and have one or at most a few users. Processing can be more informal and less controlled, although, as discussed in Chapter 12 and 13, some controls do need to be placed.

Fundamentally, people build databases because they want to keep track of something. To accomplish this goal, the database must be surrounded by applications that allow the users to enter data, to change data, to answer queries, and to produce reports. For a mainframe database, there is a staff of systems analysts and programmers who construct both the database and the applications. On a micro database, there is generally no such staff. The users must design and implement their own database and build their own applications.

This book is intended to help you do just that.

Learning a Process via R:base 5000

The subject of this book is a *process*—the process of building databases and database applications. It is not the goal of this book to teach you the ins and outs of R:base 5000 or any other database product. From our years in the classroom, however, we know that learning a process requires practice. Perhaps you have heard the adage:

> "I hear and I forget; I see and I remember;
> I do and I understand."

It would be impossible to learn how to make pottery in the abstract. At some point, you have to pick up a pot and examine it; then you need to see a picture of a pot on the potter's wheel; and finally, you have to place some clay on the potter's wheel and work it yourself.

Just the same, you cannot learn how to build databases and database applications in the abstract. Therefore, throughout this text, we have illustrated the process of designing and building databases with a commercial database manager called R:base 5000.

We chose this system for three reasons. First, it is a complete system that is more than adequate for the task at hand. Second, R:base was an efficient choice for us since we already knew and loved it. Finally, we

chose this product because Microrim (the publisher of R:base) was willing to arrange with SRA (the publisher of this book) to provide you with a student version of the product. The licensing arragement is as follows: Your instructor has been given a copy of the student version of R:base 5000 along with a license to provide purchasers of this text with a copy of the software. You have a license to use the student version of R:base 5000 as long as you have purchased a new copy of this text.

Using R:base 5000

You will learn the most from this text if you use R:base 5000 to duplicate the examples shown and if you do the exercises and projects at the end of the chapters. If you do not have a computer available, we have included numerous screens to illustrate the development process, but merely reading the material is definitely second choice.

A case example, Great Plains Music and Video Unlimited, is developed throughout the text. Additionally, we have written a second case example for you to build in parallel with the text example. Thus, as we illustrate database design for Great Plains, you can apply the underlying principles to your own case project.

Structure of This Text

The first two chapters provide background information. Chapter 1 defines database processing and compares and contrasts it to file processing. Chapter 2 presents an example of a microcomputer database application. It introduces Great Plains Music and Video Unlimited's video rental club. This example will give you an opportunity to touch and feel a microcomputer database as you assume the role of a user.

The next three chapters deal with database design. Chapter 3 introduces the concept of a database as a model. Chapter 4 provides standards and criteria for evaluating the appropriateness of a database design, and Chapter 5 illustrates the principles of database design by designing a database for the electronic components part of Great Plains' business.

Chapters 6 through 11 illustrate database implementation. We begin in Chapter 6 by implementing one table for the Great Plains database. We show how to define the table and introduce the relational operations of selection, projection, and join. In Chapter 7, we illustrate another method for defining database tables. We also show how to use a forms generator to make data entry easy. In the last part of the chapter, we introduce the use of a report generator to obtain formatted output from the database.

Chapter 8 introduces three additional relational operations: union, interesection, and difference. Chapter 9 deals with advanced report writing concepts and their implementation. Finally, Chapters 10 and 11 conclude the topic of implementation by presenting concepts of menu-driven database applications. Chapter 10 introduces the concept of a command file and shows how to use a program generator to create simple applications. Chapter 11 shows how to use command files to create more complex applications. Some of the command files used to create the sample application from Chapter 2 are used as examples.

Database administration is concerned with the management of database applications. Chapter 12 discusses database administration duties and responsibilities and Chapter 13 considers the important issue of database security. Where appropriate, the chapters illustrate the use of R:base 5000 to implement the concepts discussed.

This text is concluded by discussing ways of increasing the usefulness of the database. Chapter 14 deals with natural language queries. Once again, the Great Plains database is used for illustration. Finally, Chapter 15 presents concepts of multi-user databases using local area networks.

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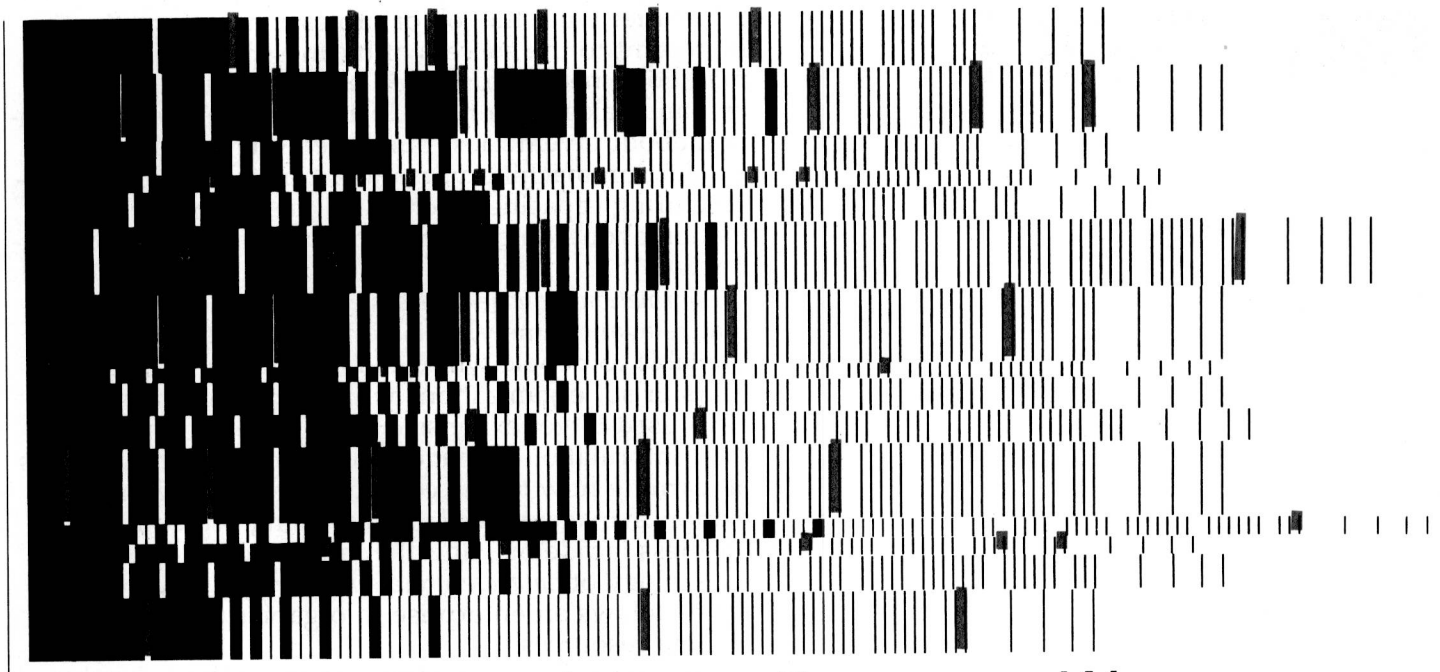
CONTENTS

CHAPTER 1 Introduction



PREVIEW

In this chapter, we'll discuss the concept of database processing as a style of computer processing and its advantages and disadvantages. We'll also explain how database processing differs from file processing. Last, we'll talk about the five components of a computer-based information processing system: people, procedures, data, programs, and hardware.

No matter what the job or profession, information is important to the success of businesspeople. People in marketing need information about products, customers, and sales orders. Production people need information about inventories, purchase orders, shop orders, production machinery, manufacturing costs, and manufacturing capacities. Personnel managers need information about job openings, pay scales, and union contracts.

Information management systems are used to ensure that relevant, timely, reliable information is made available to people who need it. Over the past 30 years or so, organizations which could afford them have used large, expensive mainframe computers in their information management systems. In the process of learning how to use computer technology in information management, data processing professionals in business, academia, and the military developed the technology of *database processing*—a style of processing which allows an enterprise to organize and integrate its data resources.

More recently, microcomputer technology developed in the exploration of space has been applied in the production of inexpensive tools for use in the information management systems of organizations of all sizes. In addition, various vendors of microcomputer software have developed programs which bring database processing technology to the microcomputer environment. That's what this book is about—database processing with microcomputers to manage information.

WHAT IS DATABASE PROCESSING?

Database technology allows data to be processed as an integrated whole. It reduces the artificiality imposed by separate files for separate applications and permits users to access data more naturally.

To appreciate this concept, consider the three information processing systems shown in Figure 1–1. These are *file processing systems;* they are predecessors of database systems. With file processing, each file is considered to exist independently. The payroll system in Figure 1–1 processes only the faculty data file; the class scheduling system processes only class data; and the grade posting system processes only student data. These systems are effective in that they produce the desired results: payroll checks, class schedules, and grade reports.

But suppose someone wants to know the salary paid to each instructor who teaches a class scheduled by the class scheduling system. To obtain this information, a new program must be written to extract data